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No. 1

ALCOHOL

SOME FACTS REGARDING ITS EFFECTS
UPON THE HUMAN BODY

Brought out by Modern Investigation

THE ASSOCIATED CHARITIES OF BOSTON
43 HAWKINS STREET, BOSTON, MASS.

1912



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The Committee on the Alcohol Problem hopes that this pamphlet may be of service in helping to educate the general public as to the true nature of alcohol.

ALCOHOL.

Some Facts regarding its Effects upon the Human Body brought out by Modern Investigation.

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*Secretary of the Committee on the Alcohol Problem of the Associated Charities
of Boston.*

1. INTRODUCTION.

Every one is familiar with the stereotyped method of teaching children the harmful effects of alcohol. The subject is inevitably associated in our minds with textbooks made up largely of lurid pictures of fatty hearts, reddened and bleeding stomachs, or enormous livers exhibiting wart-like outgrowths all over their surfaces. Until within a few years these books have been greatly in vogue and I doubt not are still used in some parts of this country.

Such books had the common fault of laying most of the emphasis upon the changes in the actual structure of the body found after death in certain individuals following prolonged, excessive use of alcohol as a beverage. The average child after studying one of these textbooks gains the impression that every habitual drinker must have a large liver, a dilated heart, Bright's disease, hardening of the walls of the arteries and nerve cells distorted out of their original shape, no matter in what amounts or how often he takes alcohol.

Laying aside any preconceived ideas we may have as to the effects of drink, let us see whether the facts justify us in allowing the children and the general public to continue in such a belief. It cannot be denied that one or more of these diseased conditions have been occasionally found in certain individuals

who have drunk to excess, but it is also true that they cannot be detected in very many hard drinkers, much less in the majority of habitual moderate drinkers. The changes in the liver are regarded as the most characteristic alteration in the structure of the body produced by alcohol. Such changes are of two kinds. The milder form consists of the deposit of fat in the liver cells so that that organ takes part in the general enlargement due to excessive overproduction of fat so commonly seen in beer-drinkers. The more serious change in the liver is called cirrhosis. Welch¹ says of this:—

The liver is hard and nodular, and usually reduced in size, although it may be larger than normal. The microscope shows a new growth of connective tissue between the liver lobules and atrophy of liver cells, which may also be fatty. The immoderate use of alcohol is the cause of probably over 90 per cent. of the cases of hepatic cirrhosis, and some think it is the sole cause. This disease is the result, especially, of drinking strong spirits, being rare in beer-drinkers, although not so infrequent in France, from excessive use of wines. The disease is sometimes called "the gin-drinkers' liver." Cirrhosis of the liver was found by Formad in only 6 of 250 post-mortem examinations on confirmed drunkards who had died suddenly from the effects of alcohol.² Although other statistics show a much higher percentage of cases, this disease is, upon the whole, a relatively infrequent form of chronic alcoholism, except in regions where excessive drinking of strong spirits prevails.

I have heard clinicians of experience state that such disorders of the liver are encountered in only about 6 to 9 per cent. of heavy drinkers. Similar conclusions have been reached in regard to the fatty heart, the chronically inflamed kidneys, the changes in the blood vessels and in the nerve cells.

Modern investigators are dealing with the action of alcohol just as they would with the action of strychnine, morphine, cocaine and other drugs; that is, they are studying its effects upon the living person and finding out how much it interferes with the normal functions of the body. After prolonged experiments with animals, such as those conducted by Dr. Julius Friedenwald upon rabbits, lasting for four years, it has been

¹ Welch: "Physiological Aspects of the Liquor Problem," John S. Billings, editor, 1903, Vol. 2, p. 367.

² See also Rolleston: "Diseases of Liver, Gall-bladder and Bile Ducts," 1905, p. 182.

found impossible to reproduce satisfactorily in them such diseases of human beings as cirrhosis of the liver, chronic Bright's disease and the changes in the walls of the arteries called arteriosclerosis, no matter how much alcohol was given or for how long administered.¹ It has been possible, however, to produce in animals certain disorders resembling those seen in persons using alcohol habitually. The disorders referred to are principally functional disturbances of the nervous system, diminished powers of resistance to various contagious diseases and defective powers of nourishing offspring. These were produced by doses of alcohol too small to cause any signs of intoxication in the animals experimented on.² These facts lead us to the conclusion that the older textbook writers, in their attempts to impress upon children the evils of drinking, laid too much stress upon the less common structural diseases found in only a limited proportion of excessive drinkers, while at the same time they lost sight of the more common and no less serious effects upon important functions of the body following the fairly constant use of alcohol in doses which many would not consider excessive.

It will simplify matters if we regard alcohol as a drug having a definite action just as strychnine, morphine or cocaine have. In sufficient doses its effect may be so poisonous as to interfere seriously with the functions of the body, and when taken in very large amounts it has caused death. Let us see if there is anything in the method of origin of alcohol which will throw light upon its poisonous action. Alcohol is formed by the action of yeast upon sugar. The yeast plant, like other fungi, cannot build up its own food as can grass and the green herbs generally, but has to live upon the food materials of other plants. Its food consists largely of the sugars of decaying fruits. The yeast plant uses these sugars for energy, and throws out carbonic acid gas and alcohol as waste products derived from the sugar. If these waste products were retained within the yeast plant they would clog its vital processes and destroy it as truly as ashes clog and put out a fire if allowed to accumulate. Yeast is responsible for the fermentation of grape juice, cider, maple

¹ Welch: *Loc. cit.*, p. 361.

² Hodge: "Physiological Aspects of the Liquor Problem," Vol. 1, pp. 361-375.

syrup, etc., and is the agent used in the manufacture of beer and light wines. As the yeast plant continues to grow in grape juice, for example, it continually gives out alcohol, — the waste product of its food, the grape sugar. The alcohol soon accumulates in the wine thus formed, and when it has reached the point where it constitutes about 12 per cent. of the total fluid in the bottle it poisons the yeast itself so that most species cease to grow, and when the concentration reaches about 14 per cent. all activity on the part of the yeast cells ceases.¹ Some varieties of white mold and yeast are much more sensitive to alcohol, so that from 1 to 4 per cent. will be sufficient to stop all activity and fermentation.² Alcohol is thus a poisonous waste-product of the activity of the yeast plant. It may be compared to the carbonic acid gas given off by a burning lamp. This gas is a poisonous waste-product of the burning oil, and if the room lighted by the lamp were to be kept absolutely tight, so that none of this gas could escape, it would accumulate to a sufficiently high percentage to destroy all the persons in the room. Thus we have the explanation of the fact, brought out by many experiments, that alcohol is a poison to the higher plants and all animals.³

We are so familiar with whiskey, brandy, rum and other liquors that we are prone to forget that they contain large amounts of a substance the action of which in sufficient doses is that of a powerful narcotic. Alcohol should be regarded as a dangerous drug. It is a serious question whether its sale should not be subject to further restriction than at present.

Like the other narcotics alcohol may act injuriously without leaving conspicuous traces of its action in the actual structure of the body, even with continued use. Surprising as it may seem, the majority of the patients admitted to the Massachusetts State Hospital for Inebriates at Foxborough show nothing wrong with the various organs of the body on the most careful physical examination. Of 500 patients recently examined at that institution only about 16 per cent. showed real evidences of disease, according to statistics given out by the resident

¹ Oppenheimer: "Die Fermente und ihre Wirkungen," Leipzig, 1900, S. 228. Quoted by Hall in Journal of Amer. Med. Ass'n, Vol. 48, pp. 393-396.

² Hall: Journal of Amer. Med. Ass'n, Vol. 48, pp. 393-396.

³ Hall: *Loc. cit.*

physician, Dr. Irwin H. Neff. Yet there is something radically wrong with these men. Alcohol is doing its work insidiously, but none the less surely, and in this respect it resembles other serious forms of poisoning. The fact that visible traces of its action are not at hand does not indicate the harmlessness of alcohol, because some of the most dreaded diseases and some powerful poisons produce no changes in the structure of the body as yet discovered. As examples of these may be mentioned insanity and morphine. In some forms of insanity microscopic examination fails to show any demonstrable alterations from the normal in the brain or other organs. There is no suffering to be compared to that of the morphine habitué, whose life is useless to himself and society; yet after death there may be nothing found in his body which could be laid directly to the charge of the drug.

Certain persons have a remarkable tolerance for alcohol as is the case also with animals. Welch says that in the experiments of Dr. Friedenwald with rabbits, already referred to, —

Certain individuals were found to be so resistant that they seemed capable of tolerating daily intoxicating doses of alcohol for an indefinite period. Thus one rabbit was given alcohol for over four years receiving in this time over four liters (about a gallon) of absolute alcohol without permanent ill effects; others were fed with alcohol for three and a half and for three years. These animals had the best of care and were kept under excellent sanitary conditions. On the other hand, some of the rabbits died from acute intoxication after a few doses, and the majority succumbed after shorter or longer periods of time, with gradual loss of weight and exhaustion.¹

The rabbit mentioned as showing such remarkable resistance to the action of alcohol was one out of 120 rabbits used. It is safe to conclude that such tolerance is rare in both human beings and in animals.

In times past the drunkard was looked upon as a criminal, and he is still treated so in our courts of law, but we are beginning to realize that his debauches are frequently the manifestations of a real disease, *i.e.*, chronic alcoholism, and not always due to moral lapses. The constant use of alcohol in ever-

¹ Welch: *Loc. cit.*, p. 355.

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"The cold gray dawn of the morning after" is an apt description of the feelings of the drinker on the day following a carouse. On awaking from his deep stupor he is often assailed by a feeling of great depression which may persist for a day or two, accompanied by some loss of appetite and occasionally nausea. His powers of concentration of mind are appreciably lessened for a period of twelve to twenty-four hours, although he may think he is doing his work as well as ever.¹ This depression often prompts the drinker to take still further doses of alcohol to "brace him up," so that the after-effects of the carouse are prolonged for several days, and the individual's efficiency in business suffers for the time being.

To sum up, then, in acute alcoholic intoxication the action of alcohol is that of a narcotic which attacks the most highly developed and most complex portions of the brain first and then the less highly developed and more automatic centers.

Drunkenness is somewhat schematically divided into two stages: (1) excitement and (2) paralysis. In reality paralysis is present from the beginning, but in the first stage it is limited to the highest psychic functions and is masked by the intensity of the automatic phenomena, so that it does not become evident until the second stage, when *all* the nervous and mental functions become involved in the paralysis.²

Let us now turn our attention to the chronic alcoholic,—the man who is in the habit of getting drunk once or twice a week and who takes something to drink almost every day. We have seen that in the majority of cases the man who becomes acutely intoxicated once may recover entirely at the end of forty-eight hours. I say in the majority of cases because there have been a few instances recorded in which the nervous system never recovered from the shock of the single carouse.³ How is it with the man who repeats the process week in and week out? For a time he may do this with apparent impunity, but that is only for a time. A slow but permanent impairment of the higher brain functions gradually becomes noticeable. In the majority of cases the first evidence of this is the gradual decline

¹ Fürer: *Neurologische Centralblatt*, 1895, p. 623.

² DeFurac: "Manual of Psychiatry," Trans. by Rosanoff, 1st edition, 1905, p. 138.

³ Crothers: *Interstate Medical Journal*, October, 1901.

of the creative ability. The power to do original thinking, to invent, to open up new avenues of business activity or of science, which constitutes the highest form of mental activity, is the first to be lost. Kraepelin states that alcohol exerts "a depressant action when the mind is engaged in purely receptive or constructive operations." It is interesting in this connection to have the testimony of that most productive scientist, Helmholtz, one of the greatest original thinkers, who stated that the smallest quantity of alcohol sufficed to dispel from his mind every idea of the creative order when he was trying to give form and being to some dimly seen conception.¹

As time goes on, following the loss of initiative there appears noticeable diminution in the power to concentrate the attention upon one thing for any length of time. The habitual drinker's mind acts as if continually fatigued. Thus it is not at all surprising that business ability diminishes because the very factors which contribute to the making of a successful business man are constantly being undermined. Judgment and ability to reason clearly become things of the past to the chronic alcoholic.

The moral part of the individual suffers equally with the intellectual. His finer sensibilities are impaired by degrees. He becomes indifferent to the needs of his home, and apparently does not care whether he is able to support his wife and children or not. He may associate with men and women of loose morals to such an extent that all regard for the sanctity of the marriage relation is lost, and it becomes a matter of small moment to him if his family is broken up and the children taken from him. Finally, at the end of a few years of constant heavy drinking, will power and self-respect seem utterly gone. The man may wish in a feeble sort of way to reform and stop drinking, but he has nothing to build on. All the powers of mind which are at hand in the normal man to carry out his wishes are now totally lacking in the drinker. Memory begins to fail, first for recent happenings and later for events which happened in the more remote past.²

Striking evidence in favor of the narcotic action of alcohol is afforded by these chronic heavy drinkers. Whenever they are unable to get anything to drink they exhibit marked nervous

¹ Abel: "Physiological Aspects of the Liquor Problem," Vol. 2, p. 125.

² DeFursac: *Loc. cit.*, p. 142.

irritability. They are either unable to sleep without taking drugs or what sleep they get is fitful and disturbed. They are quarrelsome, quick tempered, and liable to terrific outbursts of anger in which they may seriously injure any one who dares to oppose their slightest whim. Some of them develop alcoholic epilepsy, which resembles true epilepsy very closely.¹ I have had my attention called to just such a case recently. The man is a hard drinker who had his first epileptic attack about ten years ago. The attacks have increased in frequency so as to interfere seriously with his occupation. He is a teamster and on more than one occasion has fallen from his wagon. When he abstains from alcohol for a time the fits cease, but recur as soon as he goes back to his whiskey.

Almost every physician has had dealings with these unfortunates who come to the hospital or to his office begging for something to allay the feeling of "terrible nervousness." They have become so accustomed to the constant soothing effect of alcohol, which deadens all unpleasant bodily sensations and mental worries, that when this is withdrawn their sufferings are intense. Their teeth are on edge and every nerve seems on fire. Unfortunately, in spite of the physician's warnings, these men usually seek the saloon again as soon as they have succeeded in earning a few cents, in order to regain the calm which alcohol alone can give them by stifling the remonstrances of a body worn out by dissipation.

Thus these chronic alcoholics continue to drink. Some of them do so from habit merely. They have become so accustomed to the ale-house and its surroundings that it constitutes their world; they have no friends but those who, like themselves, hang around the saloon. Habit consequently keeps them at it. There are others whose condition in life has become so utterly miserable through loss of occupation, friends, home and all the comforts associated with home-life, that their one desire is for the anaesthesia of alcohol to enable them to forget it all.

Very frequently in the constant tippler alcohol causes actual structural changes in the more important nerve trunks. These begin usually in the legs and may extend to the arms. He first notices sharp neuralgic pains in his legs, feet and hands, fol-

¹ DeFurac: "Manual of Psychiatry," p. 151.

lowed in a few weeks by weakness and later paralysis of the parts affected. If the condition is severe he may be rendered absolutely helpless by his inability to use either legs or arms. Even when prevented from taking alcohol he usually recovers very slowly, so that it is several months before he is able to resume work.¹ This disease is known as alcoholic neuritis.

Alcohol, usually in combination with the excessive use of tobacco, has a somewhat similar effect upon the nerve fibers which connect the eye with the brain. The result is that the chronic alcoholic may develop a small color-blind spot in the center of the field of vision of each eye.² This was brought forcibly to the attention of the medical profession in the days before railroads enforced rules against the use of alcohol by engineers. (It was found that every now and then an engineer was unable to distinguish whether a signal light at night was red or green, and consequently was just as liable to run by a red light and cause a wreck of the train as if he had been totally blind. The examination of such cases shows that all of them are color blind in this central spot for red and green, but this defect may escape notice unless the eyes are tested in a dark room with a small colored light the size of a distant signal light. Many railroads now use this method of testing the vision of applicants for the position of engineer, and it is an important means of safeguarding the traveling public.) It must be kept in mind that the majority of cases of color blindness are due to inborn defect and not to alcohol. That form peculiar to alcohol and tobacco poisoning usually escapes the notice of the sufferer and his friends because he easily recognizes large patches of color; it is only small points of color such as are produced by lanterns at night that he is unable to recognize.

There can be little doubt that the excessive use of liquors, both fermented and distilled, is the cause of much insanity. Dr. Henry W. Mitchell, superintendent of the Danvers State Hospital for the Insane, stated recently that 20 per cent. of the men and nearly 8 per cent. of the women committed each year to that institution are there because of drink. This seems a conservative estimate and agrees well with figures given by

¹ Osler: "Practice of Medicine," 6th edition, 1905, pp. 1001, 1002.

² *Ibid.*, p. 1008.

investigators in other parts of the world, as the following statistics from Great Britain show:¹—

Proportion of Patients admitted in whose Cases Intemperance was assigned as a Cause of Insanity, to the Total Number of Admissions into County and Borough Asylums, Registered Hospitals, Naval and Military Hospitals, State Asylums and Licensed Homes in England and Wales.

YEAR.	Males (Per Cent.).	Females (Per Cent.).
1876,	22.7	7.8
1879,	22.1	7.6
1888-92 (average for five years),	20.5	8.1
1898-1902 (average for five years),	22.8	9.5

In this connection I wish to quote Dr. S. E. Jelliffe of New York, who made the following remark during the session of the American Medical Association at Atlantic City in June, 1907. In the meeting of the section on nervous and mental diseases he said:—

The subject (of alcoholic insanity) is one of the most interesting and important in the whole field of psychiatry, since there is no single substance that is so widely used as alcohol, and no substance which in its use produces such widespread and manifold mental effects and leads to so much mental breakdown.²

The most common form of insanity produced by alcohol is delirium tremens. This distressing disorder hangs over the head of every chronic excessive drinker, ready to descend upon him without the slightest warning at the very time when he is least able to cope with it. One of its characteristics is that it frequently makes its first appearance closely following the onset of some illness such as pneumonia, or some injury such as a broken leg, which confines the patient to bed. Under these circumstances it frequently aggravates what otherwise might have been a slight illness to such an extent as to make the outlook grave, and many a fatal outcome is to be attributed to it. Delirium tremens is characterized by a trembling of the

¹ John Burns, M.P.: "Labor and Drink," 5th Lees and Raper Memorial Lecture, 1904, pp. 21, 22.

² Journal of Amer. Medical Ass'n, Vol. 49, p. 1653.

entire body and by delirium, in which the patient manifests intense fear of imaginary objects about him. He peoples his room with the most terrifying animals and ferocious savages which he sees making for him, threatening him with death or serious bodily harm. He becomes so occupied in watching these creatures and endeavoring to escape from them that he can neither eat nor sleep. If he has any illness which requires that he be kept in bed it is necessary literally to bind him hand and foot to keep him from getting up and running away from the terrifying monsters which beset him on all sides. The patient keeps up a constant twisting and turning if in bed, or runs or walks about the room if up, talking and shouting incessantly. This tireless activity is most difficult to control, and unless sleep can be induced by large doses of powerful hypnotics the man may die from pure fatigue. The attack is usually recovered from, but if alcoholic excesses are kept up a return of the trouble is to be expected, and as a result of repeated attacks, permanent insanity.

A form of mental disorder somewhat resembling delirium tremens is known as alcoholic hallucinosis.¹ This is much slower in onset than delirium tremens and more prolonged in its course. The drinker gradually becomes distrustful, uneasy and suspicious of his associates. Then he begins to hear imaginary voices talking about him, abusing him and threatening him with violence. He frequently believes that detectives are after him and he can hear them talking of some crime he has committed. Such a patient has been known to purchase a revolver and get up in the middle of the night and fire it at random about the room, thereby hoping to defend himself from his persecutors. Recovery is slow, and a slight permanent impairment of intellect is apt to remain. In these cases attempts at suicide to escape from the persecuting voices heard are common.

A more serious type of mental disorder occurring in the chronic alcoholic is known as alcoholic delusional insanity. This occurs somewhat later in life than the two forms of insanity just mentioned. It frequently follows upon one or more attacks of either delirium tremens or alcoholic hallucinosis, but may

¹ Mitchell: Amer. Journal of Insanity, 1904, Vol. 71, No. 2, pp. 255-267.

come in a person who has used distilled liquors steadily for many years without any previous definite mental disturbance. It is characteristic of this type of alcoholic insanity that a patient, if a married man, becomes suspicious of his wife, interpreting her slightest act as evidence of infidelity to him. He sees a paramour in every man who chances to loiter on the street near his door, and he frequently accuses his wife or other members of the household of putting poison in his food to get rid of him. Such patients become so unreasonable and surly that they have to be confined in an asylum for prolonged periods. Very few such cases ever recover sufficiently to return to their usual occupations.¹

The most hopeless of these afflictions is alcoholic dementia. It is a gradual loss of all the elements which go to make up the personality, occurring, as a rule, in those who have been daily drinkers for many years. Memory, ambition, initiative and emotions fade out by degrees so that the patient becomes more or less of an automaton. This condition may be regarded as the end-result of the other forms of alcoholic insanity or of daily drinking for a prolonged period without previous insanity. The patient cares nothing for his family, cannot realize his condition, regards his confinement as a joke and is contented to remain in an asylum the rest of his life, taking less and less interest in what goes on about him as time progresses.

So far we have considered the effects of alcohol when taken to the point of acute intoxication, and also when taken continuously over a considerable period of time, thus producing the evils attendant upon chronic alcoholism. There is a third type of alcoholism known as dipsomania. This disease occurs in those with "a strong hereditary tendency to drink."² The dipsomaniac may be a person of temperate habits ordinarily, to whom alcohol is frequently distasteful in his normal condition.³ He would impress the chance acquaintance as being a perfectly healthy individual in every way, and even his best friends may be kept in ignorance of his trouble for years. Such a man will suddenly be seized with an absolutely uncontrollable impulse to drink and will go on a spree which may last for a week or two.

¹ Mitchell: Amer. Journal of Insanity, 1904, Vol. 71, No. 2, p. 271.

² Osler: *Loc. cit.*, p. 369. ³ DeFursac: *Loc. cit.*, p. 307.

Then he will return to his work and will be entirely free from any craving for alcohol possibly for several months. The attacks are usually ushered in by a vague sense of uneasiness, restlessness and depression. The only way to prevent a dipsomaniac from satisfying his overpowering desire for alcohol is to lock him in a room with an attendant and keep him there until the attack is over. The patient is not at all responsible for these recurring sprees, as they are due to overwhelming impulses which he cannot control.

Dipsomania, with its mysterious sudden attacks, resembles epilepsy in many ways and has been regarded by some as a type of epilepsy due to alcoholism in the parents. It attacks those portions of the brain which control the emotions and desires instead of those portions controlling the movement of the various parts of the body as in ordinary epilepsy. Whatever may be its explanation it is the most hopeless type of alcoholism. The attacks recur in spite of all treatment, and the patient may eventually become a confirmed alcoholic.

The habitual moderate drinkers constitute probably the largest class of users of alcohol. This class is responsible for much of the harm done by drink because moderate drinkers, by inviting friends to drink with them, start many a man on the road to becoming a chronic alcoholic, and by their example and by the well-known force of suggestion they induce others to drink who by constitution are unable to indulge in moderation. Again, if it were not for the great army of moderate drinkers, society would probably long ago have refused to tolerate the liquor traffic. What shall we say of the so-called "moderate" use of alcohol? Is it as devoid of bad effects as many would have us believe? Let us look at the facts in the case.

At the outset it is well to consider the question as to why men take alcohol. Archdall Reid¹ divides drinkers into three classes: first, those who drink merely to satisfy thirst; second, those who do so to gratify the sense of taste, — wine-drinkers principally; and third, those who drink "to produce, by alcohol circulating in the blood, and acting directly on the brain, a stimulation or what feels like a stimulation, but which soon becomes a narcosis." This third class probably comprises by

¹ Archdall Reid: "Alcoholism: A Study in Heredity," pp. 72-75.

far the majority of those who are called habitual moderate drinkers. They take alcohol to promote ease and sociability by dulling the sensations of bodily and mental fatigue, worry and care.

The speech and bearing of men, the play of their features, all bear witness to the action of alcohol on the brain; it removes restraints, blunts too acute sensibilities, dispels sensations of fatigue, causes a certain type of ideas and mental images to follow each other with greater rapidity, and gives a "cerebral sense of richness."

Thus Dr. Abel fitly describes the effect of moderate drinking.¹

Granting, then, that most moderate drinkers take alcohol for the sake of the effect upon the nervous system just mentioned, we see at once a danger in such use of the drug. Alcohol belongs to the group of narcotics. In the habitual use of these substances the effect produced at first by small doses can later on be elicited only by ever-increasing amounts, until eventually the craving is satisfied only by a dose which, if taken for the first time, would have very serious consequences. Alcohol is no exception to the rule, and if habitually taken for its sedative action must be used in larger and larger amounts. I do not deny that there are many moderate drinkers able to limit themselves to a definite amount of liquor which is indeed moderate. What every one should know is, that with the moderate use of alcohol a habit is deliberately formed which may eventually lead to greater excesses.

Intoxicants

Apart from this danger there are other disadvantages of sufficient import to deter any one from the use of intoxicants in the most moderate amounts. Careful experiments have been made by a number of trained scientists to determine whether moderate quantities of alcohol have any effect, good or bad, upon the individual. In the forefront of such investigators stands Kraepelin. His experiments were carried out somewhat as follows: the simplest activity of the nervous system is in the production of a definite movement of some portion of the body in response to a certain stimulus. He instructed the person used in the experiment to press a button the instant he heard the click of a telegraph instrument placed at his side.

¹ Abel: *Loc. cit.*, Vol. 2, p. 142.

The exact time of the click and also of the pressing of the button in response to the click were automatically recorded. This was repeated many times. On certain days the person took alcohol before the experiment began, on others he had none. This was to test the effect of alcohol upon the "simple motor activity" of the individual.

The "choice reaction" is the name given to a slightly more complicated activity of the nervous system. A description of the experiment will show what this is. The person used as the subject of the experiment was told, for example, that he would be shown either a white card or a black card and that he was to respond to the black card by a movement of his right hand and to the white by a movement of the left hand. This test, likewise, was carried on both with and without alcohol, the time being accurately measured between the instant of the appearance of the card and the performance of the necessary movement. In another variety of experiments the subject was given a word and required to give another word which would rhyme with the first. Here again the influence of alcohol upon the time required to think of a rhyme was determined.

All the activities just enumerated require very little thought or deliberation, but are very nearly automatic. Kraepelin found that small quantities of alcohol, equal to that contained in about $\frac{1}{3}$ of a bottle of claret, which is about 10 per cent. alcohol, hastened such simple mental processes so that the subject would press the button or give a rhyme quicker than without the alcohol.¹

The result was very different when he studied the more complicated forms of work preformed by the nervous system. He had the subject add up columns of figures with and without alcohol, and determined both the difference in the time required to do this and also the number of mistakes in addition which were made. In another exercise he gave a word to the subject who was required to respond with a word suggested by the first. For example, if the word given was "sailor," the subject would reply "ship" or "sea." These experiments, simple though they are, require a certain degree of concentration of mind and reflection. He found that alcohol even in very

¹ "Physiological Aspects of the Liquor Problem," Vol. 2, p. 124.

small quantities lengthened the time required to add the figures and increased the number of mistakes made. The same was true of the word-suggestion test; the subject had to think longer before giving the name of some object suggested by the first word.

In the light of these experiments it seems fair to conclude that very small quantities of alcohol delay all mental activities which require any degree of reflection or reasoning. When larger amounts, such as would be found in a bottle of ordinary wine, were taken, Kraepelin found that every type of mental operation was depressed at once, from the pressing of the button in response to the click of the telegraph instrument to the adding of columns of figures. Whether the processes are simple or complex, whether they are largely automatic or require judgment and concentration, the alcohol slows them all down and makes them less accurate.¹

The experiments in rifle-shooting conducted by the Swedish government,² and those in typesetting carried on by Aschaffenburg,³ may be cited as confirming Kraepelin's conclusions. The experiments in shooting were conducted by Lieut. Bengt Boy upon 6 picked Swedish soldiers, none of whom were total abstainers. There was one experiment each day consisting of seven rounds of rapid-fire practice, each round lasting half a minute. On certain days the men practiced without having taken any alcohol. On other days alcohol was administered as follows: on the evening before the practice about one ounce of alcohol was given in the form of punch; on the next day, twenty minutes to half an hour before the shooting began, about one and one-half ounces of brandy were taken by each soldier. On the five days when alcohol was given them the men missed 27 per cent. of their shots, whereas on the days of total abstinence the percentage of shots missed ranged from 7 to 4.6 per cent.

The experience of Aschaffenburg with typesetters is very instructive in this connection, as it tends to "show the influence of alcoholic beverages on the efficiency of men engaged

¹ "Physiological Aspects of the Liquor Problem," Vol. 2, p. 124.

² International Monatschrift zur Bekämpfung der Trunksitte, July, 1904. Heft 7.

³ Abel: *Loc. cit.*, Vol. 2, pp. 156, 157.

in a pursuit which involves little muscular effort, . . . but rather an accurate muscular response to mental performances." The experiments were performed on four Heidelberg type-setters who had volunteered to serve as the subjects of them: —

These men were respectively forty-two, thirty-six, twenty-five and twenty-three years old; and even the youngest had been engaged in his trade for nine years. The oldest of the party was accustomed to take 4 glasses of beer a day, except on Sunday, when he had from 8 to 10 glasses; the second took 1 or 2 glasses on week days and 4 to 5 on Sunday; the third took none on week days and 2 to 3 glasses on Sunday; the fourth took 3 glasses a day during the week and 5 to 6 glasses on Sunday. All stated that on Monday their work was less easily performed, and that they made more mistakes. No. 3 felt dull and languid, and No. 1 complained of headache, dizziness and sleepiness, and often had all the symptoms of a man who had been on a spree the day before.

In order to secure "normal" days for tests, that is, days on which the experiments were to be made without alcohol, the men were required to abstain entirely from alcoholic beverages for the twenty-four hours preceding. The tests, both with and without alcohol, were made at the same hour each day; the men worked in their usual places in the printing establishment, and used type with which they were thoroughly familiar; and instead of a written manuscript, printed material was used as "copy." In short, the experiments were so arranged as to constitute the sort of test required in practical life, and yet meet the requirements of laboratory exactness. . . . Four days were used for the tests, the first and third of which were "normal" days; the second and fourth were "alcohol days." On the alcohol days each man received 200 grams (an ordinary tumblerful) of a Greek wine, containing about 18 per cent. of alcohol, a quarter of an hour before the trials took place.

Aschaffenburg found that the alcohol given caused no change in the quality of the work as compared with that of days when no alcohol was given. It *did*, however, diminish the *amount* of work done. "Among the 8 trials there was but one in which the amount of type set was not below that of the normal days. Assuming that fatigue and practice had no influence on the result, the diminution in output amounted to 15 per cent. of the expected output." Here is strong evidence in support of Kraepelin's conclusion that small quantities of alcohol delay work requiring intellectual effort of a moderate sort. How much greater must its retarding effects be in business men deal-

ing with great problems requiring the keenest judgment and insight.

Abel, in his comprehensive article in "Physiological Aspects of the Liquor Problem,"¹ thus sums up the effects of moderate drinking upon the nervous system:—

Experiments made on the effect of the continued daily administration of 40 to 80 grams of alcohol (equal to about 1 to 2½ bottles of ordinary wine) show a decrease after a few days in the ability to memorize and to add figures. . . . As to the action of alcohol on the several senses, both special and general, it may be stated that in any but very small quantities it has a sedative or depressant action. The power to make "eye-measurements," a function which is called into play in many of the arts and industries of life, is distinctly depressed when the individual takes a bottle of wine. Similar large quantities of alcohol diminish the acuteness of the senses of smell and touch.

It will be seen that alcohol is not found by psychologists to increase the quantity or vigor of mental operations; in fact, it clearly tends to lessen the power of clear and consecutive reasoning. In many respects its action on the higher functions of the mind resembles that of fatigue of the brain; though with this action is associated a tendency to greater motor energy and ease.

This latter is clearly described by James, who says, "It is the absence of scruples, of consequences, of considerations, the extraordinary simplification of each moment's outlook, that gives to the explosive individual such motor energy and ease." This description aptly applies to the individual who is under the influence of a "moderate" quantity of alcohol. It tends to turn the inhibitive type of mind into the "hair-trigger" type (James).

To such facts as these many a moderate drinker replies, "Granted; but I do not take my wine in the morning before going to work but in the evening as a sedative to quiet my nerves and make me forget the cares and worries of the day." Such a man overlooks the facts in the case. We have learned during the last few years that the effect of alcohol upon the nervous system is much more prolonged than formerly supposed. Fürer² conducted experiments to determine just how long this effect lasts. When alcohol was taken in the morning to slight intoxication the mental effects were noticeable the whole

¹ Vol. 2, pp. 141, 142.

² Fürer: *Neurologische Centralblatt*, 1895, p. 623.

of the next day; when taken at night the after-effects were very definitely observed on the evening of the following day. These after-effects were a diminution in the ability to add figures and a very definite weakening in the power to memorize columns of figures. In view of the fact that these observations have recently been verified by Rüdin¹ I think we are justified in concluding that the use of alcohol, even after the day's work is over, is not without its detrimental effects upon the next day's efficiency in business.

In all of these experiments very striking evidence of the false sense of stimulation produced by alcohol was obtained. Almost all of the persons experimented upon were under the impression that they were doing better and quicker work after taking alcohol than before. The soldiers thought their shooting greatly improved by the brandy they took; the subject thought he was adding the columns of figures more rapidly and more accurately than before taking the alcohol. All these results tend to show that the testimony of the moderate drinker as to the benefits of drinking is unreliable and must be disregarded unless checked by the impartial observations of a trained experimenter. When thus checked we find that the disadvantages of the moderate use of alcohol by the average healthy individual far outweigh any supposed beneficial action attributed to it as a sedative. We shall see farther on that it may be of use rarely in sickness.

3. ALCOHOL AND POWERS OF RESISTANCE TO DISEASE.

In olden times sickness was regarded as a special visitation of Providence and such epidemics as smallpox and the bubonic plague — known as “the Black Death” in the fourteenth century — were looked upon as God's inevitable punishment of wickedness. To-day we know that the contagious diseases are caused by microscopic organisms, each consisting of but a single cell, belonging to either the vegetable or animal kingdom. The more common varieties are those belonging to the vegetable kingdom and are known as bacteria.

Such every-day annoyances as the common cold, boils, felonies, and decayed teeth are due to bacteria which are omnipresent,

¹ Kraepelin: Psychologische Arbeiten, 1900, S. 451.

waiting a chance to enter the body, multiply and begin causing trouble. The bacilli of tuberculosis float about in the air of crowded, stuffy quarters, and those causing diphtheria have been found as inhabitants of the throats of apparently normal persons, not suffering from that or any other disease. The questions naturally arise, why do not these people have diphtheria? Why do not all the people living in ill-ventilated tenements contract tuberculosis? Why do many people escape during widespread epidemics of typhoid fever? The answer is that there are certain forces within our bodies all ready to rush on short notice to any point where the bacteria attempt invasion and destroy the invading organisms. This sounds as if these forces were endowed with human intelligence, but as a matter of fact they are circulating in the blood, and if bacteria enter and begin to multiply these protective agents are in most cases automatically attracted to that threatened point.

A healthy person who possesses these defensive forces to such a degree that in spite of exposure to possible contagion he escapes illness is said to have good resistance. If, however, he falls a ready prey to the disease his powers of resistance are poor. Some persons have good powers of resistance throughout life, others quite the opposite. In most of us, however, resistance to disease varies. When all is going well and we keep our feet dry and avoid exposing limited areas of our bodies to a gale of cold air we keep in good health. If we alter the circulation of our blood by getting our feet wet or by sitting in draughts we thereby reduce temporarily our powers of resistance to disease, and this is the reason why a bad cold frequently follows such indiscretion. The bacteria which produce the common cold may be living in our throats as harmless parasites, but the moment our forces of defense are weakened in the manner mentioned, invasion occurs with the resulting sore throat, stuffed-up nose and cough. A cold tends to reduce our powers of resistance still more, so that the bacteria, not content with producing tonsillitis, sometimes open the way for other bacteria to invade the neck more deeply, producing an abscess back of the tonsil popularly known as quinsy sore throat. The prevalent belief that pneumonia is caused by a cold arose from

the fact that many persons have their resistance so reduced by a cold that they fall easy prey to another kind of bacterium which causes pneumonia.

Why is it that a person rarely has typhoid fever or scarlet fever a second time? The reason is this. During the course of the disease he develops a substance in his blood which raises his resistance against that particular disease so high that he finally gets the better of the bacteria and drives them out. Now this substance remains in his blood making him less liable to contract the disease than a healthy person who has never had it. This condition is known as "immunity." It holds good for only the one disease which produced it, whereas resistance is the normal barrier against all bacterial diseases.

Immunity can be produced artificially by giving the individual a disease in its mildest form. Vaccination protects us from smallpox because, when the vaccine virus is rubbed into the arm, we contract that very mild form of the disease peculiar to cows. This is so like true smallpox in character, however, that the antitoxin our bodies form renders us immune to the human disease. Lately it has been discovered that the soldiers in our armies need no longer fear typhoid fever. By injecting dead typhoid bacilli into them scientists have been able to make them as immune to the disease as if they had really suffered from it. In this way not only many soldiers' lives are being saved, but also many nurses and physicians in hospitals are protected from this dreaded disease.

Habitual drinkers have long been observed to be peculiarly prone to diseases of bacterial origin. Pneumonia is extremely common and especially fatal among them. Very exceptionally in hospital experience does one see a chronic alcoholic survive this disease. Erysipelas and various forms of blood-poisoning are more frequently encountered, and their course is more prolonged in this class of patients than in the abstinent. From these observations the belief grew that alcohol in some way lowers resistance to disease.

To determine the truth of the matter experiments have been conducted by scientists upon animals. Abbott and Laitinen were among the first to take up this problem and, although

working in different parts of the world, their results are remarkably in accord. Abbott¹ gave intoxicating doses of alcohol to rabbits daily, and as a result of numerous experiments found that their normal resistance to various disease-producing bacteria was markedly diminished through the influence of the alcohol. This was most strikingly illustrated in regard to erysipelas, a form of contagious disease commonly occurring in alcoholics. When exposed to it 6 rabbits which had received daily doses of alcohol for varying lengths of time promptly contracted the disease and died. Of 5 rabbits which had received no alcohol only 1 died of the disease. Laitinen,² working in Professor Fraenkel's laboratory in Halle, used much smaller doses of alcohol than Abbott. He gave it in the proportion of four to six drops per pound weight of the animal, well diluted, and continued the administration for prolonged periods of time. He exposed the animals to tubercle bacilli, (the bacteria causing consumption) and to diphtheria toxin (the poison formed by the bacteria of diphtheria). From many experiments he likewise concluded that alcohol makes animals more susceptible to the bacteria of disease and to the poisons formed in the body by the activity of such bacteria.

By further experiments Abbott and Bergey³ learned that the reason animals catch disease more readily after taking alcohol for a time is that the alcohol in some way weakens the forces in the blood which attack and destroy foreign cells, like bacteria, when attempting to gain an entrance into the body. Thus we see that alcohol really lowers the natural powers of resistance to disease, and we are right in ascribing many contagious diseases in alcohol users to the alcohol habit.

This is not all, however. Alcohol goes still further and tends to weaken that power of immunity which, as we have seen, protects a person from having a contagious disease a second time. Deléarde⁴ gave small continued doses of alcohol to rabbits and then tried to vaccinate them against hydrophobia and lockjaw.

¹ Abbott: *Journal of Experimental Medicine*, 1896, Vol. 1, pp. 447-460.

² Laitinen: *Zeitsch. für Hyg. und Infektions-Krankheiten*, 1900, Bd. 34, S. 206. *Acta. Societ. Scient. Fenniae*, 1900, Tome 29, No. 7.

³ Abbott and Bergey: *Univ. of Penn. Medical Bulletin*, Vol. 15, pp. 186-191. August—September, 1902.

⁴ Deléarde: *Annals de L'Institut Pasteur*, Tome 11, p. 837. Paris, 1897.

Whereas he was perfectly successful in doing this with normal rabbits, so that they became immune to these diseases, he found that it was impossible to secure such immunity in the alcohol rabbits. He found, further, that if he gave alcohol to the normal rabbits which had been made immune to lockjaw they lost their power of immunity and died when exposed to this disease. Alcohol, then, not only renders the habitual user more prone to contract contagious disease but impairs that mechanism which should protect him from a second attack.

Some diseases are due to the occupation a man follows rather than to bacteria. This is the case with lead-poisoning, a disease commonly seen among house-painters and plumbers. It is caused most frequently in these trades by the men eating with dirty hands. They get fine particles of lead from the paint on their hands, transfer it to the food they eat, and thus take considerable doses of lead with every meal. In this disease, also, alcohol plays a large part. No less an authority than Oliver¹ states, "There is not the least doubt that alcoholic intemperance predisposes to lead-poisoning." By a series of experiments upon animals to which he gave alcohol and lead in the food, he showed conclusively that the alcohol precipitated the attacks of lead-poisoning. He continues as follows:—

The intemperate habits of the working classes of Normandy and Brittany are well known. These two districts give employment to one-third of the total number of house-painters in France, and yet within their borders the death-rate from plumbism (lead-poisoning) is more than one-half that of France. . . . Normandy alone with its heavy consumption of alcohol has more than one-half of the total cases of lead paralysis in France. The influence of alcohol in these cases, as in all, is to reduce the vital resistance of the nerve cells of the workman, to render him careless as to the necessity of cleanliness, and thereby to render him more prone to plumbism.

Apart from its other harmful effects, has moderate drinking any influence upon the length of life? This is an important question, particularly in view of the frequent newspaper stories of persons living to a ripe old age because they used some special

¹ Oliver: "Diseases of Occupation," 1909, p. 147.

brand of whiskey or brandy or beer. Does moderate drinking affect life one way or the other so that the constant drinker is liable to outlive his abstinent friends, or die before they do? Fortunately, we have very accurate statistics covering a period of over sixty years, which enable us to give a definite answer to this much-debated question. They are furnished us by life-insurance records, particularly those of an English company called the United Kingdom Temperance and General Provident Institution. The history of the founding of this company is of some interest: —

In 1840 a young Quaker, Robert Warner, applied to a London office for an assurance on his life, and was given to understand that in consequence of his teetotalism he would have to pay an extra premium, as the managers of the office believed the lives of abstainers to be shorter than those of alcohol users. Mr. Warner, however, thought his chance of longevity to be superior rather than inferior because of his abstinence and so declined to accept the penalty imposed; but taking council with some other Friends succeeded later in the year in starting an office for abstainers only, which a few years after opened a section for nonabstainers and is to-day the well-known United Kingdom Temperance and General Provident Institution.¹

The experience of this life-insurance company for the past half-century is so complete and accurate, and is on such a large scale, that it would seem fair to base conclusions as to the effect of the moderate use of alcohol on length of life upon its figures. A person taking out a policy in this company is put at once into one of two groups. If he declares that he is a total abstainer he is placed in the abstainer class; if he states otherwise he is put in the class of nonabstainers.

The records of the office have been kept in such a way that the two sections can be accurately compared. The same premiums are charged for both abstainers and nonabstainers, the former receiving any advantage arising from their superior vitality in the form of additional bonus. Persons are eligible for the abstainers' section who do not take alcohol as a beverage in any form; and the continued adherence of the assured to abstinence is checked by an annual declaration to that effect. If the abstainer ceases to abstain he is transferred to the nonabstainers' section, and, on the other hand, assurers in the non-

¹ Eccles: "The Drink Problem," Kelynack, editor, p. 153.

abstainers' section who become abstainers are generally eligible for transfer to the abstainers' section. Such transfers are not made if the assurers are known to be in bad health or of intemperate habits.¹

During the sixty years that we have records of these two groups the company issued 31,776 whole-life policies of healthy male nonabstainers, of whom 8,947 died; and 29,094 whole-life policies of abstainers, of whom 5,124 died.

The mortality of abstainers for ages 20-24 is much lower than that among nonabstainers. For ages 25 and onwards up to age 74 the results are greatly in favor of the abstainers. "This advantage increases up to the group of ages 40 to 44, when it is at its maximum, being under 55 per cent. of the ordinary rate. After that age the rate very slowly approximates to the standard, being 71½ per cent. at ages 56 to 59, and 85 per cent. at the ages 70 to 74. For the group 75 to 79 the abstainers' rate is in excess of the ordinary, but for the remainder of life it is distinctly below. In general terms we may say that the feature of the abstainers' mortality is a great saving after early manhood through all the working years of life; which saving increases up to middle age, and gradually rises to the normal rate of healthy life as old age is reached at, say, ages 70 to 75."²

The excessive mortality for ages seventy-five to seventy-nine may be explained, I think, as due to the fact that by living an abstinent life many persons who would ordinarily have died earlier live to reach this ripe old age. We must bear in mind that the persons classed as nonabstainers have passed a rigid physical examination and are healthy, moderate drinkers, not drunkards by any means.

From these figures the conclusion seems justifiable that the moderate use of alcohol tends to shorten life, and that the total abstainer stands a much better chance of living to be seventy-five years old than the moderate drinker. The foregoing paragraphs in a measure explain why this is so. Alcohol impairs the forces which render the individual resistant to disease and also weakens the power of immunity which prevents him from recurring attacks of the same disease. Under the best of conditions the chances of any given man's living to be seventy years old are none too good. He who uses alcohol

¹ Eccles: "The Drink Problem," Kelynack, editor, pp. 139, 140.

² *Ibid.*, p. 143.

habitually is materially lessening his chances of a long and serviceable career.

4. EFFECTS OF ALCOHOL ON DIGESTION.¹

Food taken into the mouth is acted upon first by the saliva, later by the gastric juice in the stomach, and finally digestion is completed in the intestine by the action of the pancreatic and intestinal juices. Thus the process is a threefold one. In considering the effect of alcohol upon digestion we must take up each of these three stages separately.

When alcohol or alcoholic beverages are taken into the mouth there is an increased flow of saliva due to the mildly irritating action of the alcohol upon the mucous membrane which lines the mouth. This action is not peculiar to alcohol, but is produced by many other substances such as vinegar or mustard. It is merely temporary and passes off soon after the liquor has left the mouth. The function of saliva is to convert some of the starch in the food into products which can be easily absorbed. The active agent, "ptyalin," which causes this change, is quickly destroyed by acids. For this reason some of the saliva may have only a brief time for digestive action because the food passes from the mouth directly to the stomach, where the saliva in the food near the stomach wall is soon destroyed by the acid secretion. The saliva in the midst of the food in the large end of the stomach can continue its action, however, for a considerable period without interference by the acid gastric juice.

Pure alcohol has no marked influence upon the digestion of starches by saliva, but Chittenden¹ found by many experiments with human saliva that large quantities of whiskey, brandy or rum cause a great slowing of this process because they are acid or contain acid substances. This action is much more marked in the case of wines and malt liquors because they contain a larger percentage of acid substances. The question naturally arises as to whether it would do any harm if this process were delayed so that the saliva had no chance to act before its ptyalin was destroyed by the gastric juice. In a healthy person this would mean that the starches in the

¹ The facts given in this chapter are derived largely from the comprehensive article by Prof. R. H. Chittenden in "Physiological Aspects of the Liquor Problem," Vol. I, pp. 137-305.

food would not be digested until some hours later, when they reached the intestine and were acted on by the pancreatic juice, for the gastric juice has no power to digest starches. In a person whose health is poor for any reason this action might become a serious matter and mean the loss of nutritive material to the body.

When taken into the stomach with food, alcohol causes a more profuse flow of gastric juice than usual. This gastric juice is also more powerful than that produced by the entrance of food alone into the stomach, that is, it is capable of digesting a greater amount of food. If this were the only effect produced by the presence of alcohol in the stomach we should be justified in concluding that it exerts a favorable influence upon digestion, but there are other factors to be considered. In the first place this profuse secretion tends to attack the saliva and shorten its period of action on starches. Now that we have a more abundant and more powerful gastric juice, what is the effect of the alcohol in the stomach upon the solvent or digestive action of this fluid on the food? A most important active agent in gastric juice is pepsin which, with the hydrochloric acid in the juice, alters the albuminous portions of the food so that they can be further digested by the pancreatic juice. In his long series of experiments Chittenden found that small amounts of pure alcohol have little or no effect upon the action of the pepsin. Only when alcohol is taken into the stomach in amounts large enough to equal 5 per cent. of the total food contents is the action of the gastric juice materially interfered with. Under these conditions digestive action of the pepsin is retarded. To cause this effect a person would ordinarily have to drink half an ordinary glass of raw whiskey, rum, brandy, or some beverage equally strong in alcohol. If enough alcohol is taken to equal 15 to 18 per cent., or one-seventh of the contents of the stomach, digestive action may be reduced one-quarter or even one-third. Such an amount would be represented by nearly two ordinary glasses of raw whiskey. Thus alcohol, when taken in large amounts, after it has induced a flow of strong gastric juice, turns about and prevents this gastric juice from doing its work properly.

So far we have been considering merely the effect of pure alcohol, or whiskey, brandy and rum, the action of which is due entirely to the alcohol they contain. Wines are different. Chittenden found that they contain substances other than alcohol which affect digestion very unfavorably. In the case of sherry (20 per cent. alcohol) he found that the presence of about a wineglassful in the stomach has a far greater retarding effect upon the digestive action of gastric juice than twice that amount of raw whiskey or brandy (50 per cent. alcohol). The same is true of claret. Sir William Roberts¹ states as the result of his experiments that "as used dietetically, sherry must figure as having frequently an important retarding effect on peptic digestion. This wine is used with dinner by some persons very freely. Half a pint of sherry is no unusual allowance." He goes on to show that such an amount of the wine would be equal in bulk to about one-quarter of the food in the stomach and would delay digestion very materially. He continues: "If we consider the copious proportions in which hock and claret are used dietetically, it becomes evident that their retarding effect on peptic digestion is often brought into play. A pint of claret or hock is a common allowance with dinner for robust eaters, and such a proportion would not be without considerable effect."

With malt liquors, such as ale, lager beer, bock beer, stout and porter (having a content of alcohol ranging from 1.5 to 5.5 per cent.) Chittenden's experiments lead to the conclusion that in small quantities they are without any harmful influence on the digestive power of the gastric juice. When taken in such quantities as a pint and a half or more, they retard the digestive action of the pepsin. This is not to be attributed to the small amount of alcohol in them, but to the comparatively large amounts of other substances, known as extractives, which they contain.

We have seen from the results of the experimental work of Roberts and Chittenden that the presence of alcoholic beverages in the stomach in such quantities as are commonly taken tends to delay digestion. Another factor now enters which modifies greatly this retarding action. Alcohol is very rapidly absorbed

¹ Roberts: "Collected Contributions on Digestion and Diet," London, 1891.

from the stomach so that within a short time after entering that organ it is entirely removed by the blood in the capillaries of the stomach wall. In his experiments with dogs Chittenden gave one of the animals about a wineglassful of a 20 per cent. solution of alcohol in water. Half an hour later he was unable to find any traces of alcohol in the dog's stomach contents.

What, then, is the sum total of the various effects of alcohol upon digestion in the stomach when taken with food? Its first action is favorable in that it causes a freer flow of very powerful gastric juice. It next tends to delay the action of the pepsin if the percentage of alcohol reaches 5 per cent. of the total food material in the stomach. It is rapidly absorbed and thus prevented from delaying digestion long unless present in very large quantities. The final effect upon the whole process of gastric digestion was carefully investigated by Chittenden in a long series of experiments upon dogs, in which he compared the rate of digestion of a given test meal, to which water was added, with the rate of digestion of a corresponding meal to which alcohol or some alcoholic beverage was added. From these he concludes: ¹ —

The results collectively indicate that the period of gastric digestion is not greatly varied under the influence of alcohol or alcoholic beverages. In some few of the experiments the results indicate a slight acceleration of digestion in the presence of weak alcoholic beverages, while in others strong alcohol retards slightly the rate of digestion. Giving due heed, however, to the unavoidable errors which must of necessity attend this kind of experimentation, we believe that the results obtained justify the conclusion that gastric digestion as a whole is not materially modified by the introduction of alcoholic fluids with the food.

In other words, the two effects of the alcohol, one favorable and one unfavorable, tend to offset each other, so that when taken in reasonable amounts *with food* alcoholic drinks have little if any influence upon digestion in the stomach.

This same experimenter found that when alcohol is introduced into the empty stomachs of dogs without food it causes the same profuse outpouring of unusually acid gastric juice as occurred when food also was present. Such powerful secretion

¹ Chittenden: *Loc. cit.*, p. 151.

called forth repeatedly in an empty stomach, as must be the case in habitual drinkers, when combined with the irritating action of strong liquors upon the delicate mucous membrane of the stomach, may well cause considerable local irritation. This perhaps explains the morning nausea and vomiting of such persons on the day after a carouse. In speaking of the effect of prolonged administration of alcohol upon the stomach in animals, Welch¹ mentions reddening of the mucous membrane and an increased outpouring of mucus as among the most common conditions noted by various experimenters. In the experiments by Friedenwald on rabbits, already alluded to, these changes were found in some cases, but in many instances, even after prolonged use of diluted alcohol, the stomach appeared entirely normal, both to the naked eye and under the microscope.

Chittenden and Roberts agree that alcohol can have little if any effect upon digestion as carried on in the small intestine by the pancreatic and intestinal juices. When intoxicants, as ordinarily used, reach the intestine, practically all of their alcohol as well as most of their other constituents have been taken up by the blood stream so that they interfere very little with intestinal digestion.

The entire process of transforming food into body tissues or body energy is one of the most complex and least understood processes in physiology. Recent experimental work by Beebe² and by Reid Hunt³ has brought to light facts which lead us to believe that very moderate amounts of alcohol used habitually alter this important process at some point with the formation of certain substances which may act as poisons to the body. These substances may be responsible for the gout and the chronic rheumatism sometimes seen in habitual drinkers.

5. ALCOHOL AND THE CIRCULATION.

Flushing of the face is the first noticeable effect upon the body of taking small amounts of alcohol. To understand how this is brought about we must first consider the mechanism which

¹ Welch: *Loc. cit.*, p. 356.

² Beebe: *Amer. Journal of Physiol.*, 1904, Vol. 12, No. 1.

³ Hunt: *Hygienic Laboratory Bulletin*, No. 33.

regulates the size of the blood vessels. In the walls of the arteries there are small muscle fibers which are capable of contracting and making the stream of blood passing through smaller, or of relaxing and making the stream larger. These muscle fibers are controlled by certain portions of the brain, which are believed to be sending impulses to the arteries constantly, keeping them just the right size. Now when a man takes a few drinks the alcohol is quickly absorbed from his stomach into the blood and thus reaches the brain where, as we have seen, it at once begins to depress certain functions. Among the portions of the brain which are thus depressed are probably the areas which control the small blood vessels of the skin.¹ The normal stream of nerve impulses to the arteries is interrupted, the muscles of the vessel walls relax, and the vessels become over-distended with blood. Thus is produced the flush which is not limited to the face, but spreads all over the body. The result of the flushing is that much more blood than usual is carried to the surface of the body, where it gives up its heat very rapidly from its close contact with the cooler air. Because the skin is supplied with such an unusual abundance of blood the man feels warmer than before taking the alcohol, and is under the impression that he is being stimulated and protected from the cold. As a matter of fact, however, he is really losing his body heat more rapidly than usual, and the thermometer may show a decided lowering of his temperature if he indulges heavily in the intoxicant in cold weather.

The constant tippler is usually betrayed by his red face and especially by the enlarged blood vessels of his nose. The explanation is probably this. He keeps the vessels supplying his face so constantly engorged with blood by continual drinking that eventually the small muscles in their walls lose much of their power to contract and remain permanently relaxed. The result is the flushed face so frequently seen in cabmen and drivers of brewery wagons. We must not overlook the fact, however, that this may be caused by constant exposure to the cold without indulgence in alcohol.

Following the primary relaxation of the blood vessels on the surface, if more alcohol is taken those of the internal organs

¹ Abel: *Loc. cit.*, Vol. 2, p. 90.

become dilated. This takes place especially in the abdomen where the vessels are very large.¹ This engorgement of the internal vessels is due to a still further depression of those portions of the brain which have control of the muscles in the vessel walls. The effect of the internal dilation is that the blood, instead of returning with its usual rapidity to the heart to be pumped out again and distributed evenly over the body, is retarded in the relaxed blood vessels and the blood pressure falls. In health the blood in the arteries is kept at a fairly constant pressure in order that it may overcome the force of gravity so as to reach all parts of the brain and head and also to return to the heart from the feet. If this pressure is lowered by large doses of alcohol the functions of the circulation cannot be performed efficiently.

The foregoing discussion leads us to a consideration of the effect of alcohol upon the great central pumping station, the heart. Numerous experiments have been performed by Martin, Stevens, Hemmeter, Bock and others to determine this point. Their results are thus summarized by Abel: ² —

In respect to the action of alcohol on the mammalian heart, we have thus far found no evidence that it acts as a stimulant for this organ. The most that we are able to say is that moderate quantities, that is, such as do not lead to intoxication, have no direct action on the heart worth speaking of. The more reliable of the experiments that have been made on the action of alcohol on the heart of cold-blooded animals also fail to give support to the old notion that alcohol is a direct stimulant for the heart. . . .

In very large quantities, such, for example, as result in helpless and perhaps fatal intoxication, alcohol is seen to be a direct and powerful depressant for the heart, weakening first the auricular, later the ventricular systole (contraction), causing more or less distention of both cavities, marked slowing of its movements, and great diminution of its output of blood.

Thus we see that alcohol, contrary to the generally accepted belief, is not a stimulant to the heart or circulation but a depressant. The reason that the pulse becomes more rapid immediately after taking whiskey, brandy, or other strong liquor is that these substances, like mustard, pepper and ammonia

¹ Abel: *Loc. cit.*, Vol. 2, p. 89.

² Abel: *Loc. cit.*, Vol. 2, pp. 51, 54.

fumes, irritate the mucous membrane of the mouth and stomach. This irritation causes a very temporary reflex stimulation of the heart, which is in no way attributable to the direct action of the alcohol upon that organ, but to the powerful smarting sensation in the throat and stomach.¹

In those who habitually drink large quantities of beer much more work than normal is thrown upon the heart by reason of the excessive amount of fluid circulating through the blood vessels. Practically all the fluid portion of the beer has to be pumped by the heart before it can be got rid of by the kidneys. For this reason the heart of the beer-drinker becomes gradually enlarged to accommodate itself to its extra work. If continually overworked by the drinking of very large quantities of beer it may later become dilated, and thus unable to do its work properly. In spirit-drinkers this condition is not encountered, but there may be deposits of fat about the heart muscle which tend to encumber its action.

Richard Cabot² made a careful investigation, a few years ago, of the effect of alcohol in disease, especially with reference to the circulation. As the result of 1,105 observations upon 41 patients suffering from typhoid fever and other diseases he came to the conclusion that the ordinary medicinal doses of alcohol have no effect upon the circulation sufficient to cause any material change in the blood pressure. Its beneficial action in disease is probably due to its narcotic effect. It makes the patient feel more comfortable and quiets his fears. It is also an emergency food requiring no digestion, and is thus of value in some diseases, whereas in health its drug effect is so marked as to far outweigh any possible food value it might otherwise have.

6. INDUSTRIAL AND SOCIAL ASPECTS.

A few generations ago it was the rule not only in the army and navy but also in many forms of industry to serve the men with regular rations of grog. Sometimes the workers were actually paid part of their salary in whiskey or rum which were

¹ Abel: *Loc. cit.*, Vol. 2, p. 47.

² Cabot: *Trans. of Assoc. of Amer. Physicians*, 1903, Vol. 18, pp. 402-423.

regarded as necessities of life. Even the clergymen laid in a winter's supply of spirits to tide them over until spring.

To-day this is all changed. Alcohol is becoming universally recognized as the enemy to efficiency in every line of industry. Railroads and public service corporations have come to enforce rigid rules as to abstinence on the part of their employees as the following letters show: —

PRESIDENT'S OFFICE,
THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD COMPANY,
NEW HAVEN, CONN., Nov. 1, 1910.

W. STEWART WHITTEMORE, M.D., *The Associated Charities of Boston,*
43 Hawkins Street, Boston, Mass.

DEAR SIR: — Your letter of October 13 was duly received, and delay in reply has been due to investigation and press of other business.

On the New Haven road the matter is governed by a rule in the rules and regulations of the operating department, which reads as follows: "The use of intoxicants by employees while on duty is prohibited. Their habitual use, or the frequenting of places where they are sold, is sufficient cause for dismissal."

On the Boston & Maine the matter is governed by a similar rule, reading as follows: "The use of intoxicants by employees while on duty is prohibited. Their use, or the frequenting of places where they are sold, is sufficient cause for dismissal."

I also hand you herewith copy of application blanks used by this company and the Boston & Maine, for operating employees, upon which you will note the question as to whether the applicant uses intoxicating liquors. Naturally, if this question is answered in the affirmative it would exclude an applicant from a position in train service.

If an employee is found to be addicted to the use of intoxicants he is promptly discharged.

As regards other departments, no definite rules are in existence, except that, naturally, we endeavor to ascertain an applicant's habits before employment, and, of course, employees are relieved if they are addicted to the habitual use of intoxicating liquor.

Trusting this gives you the information desired, I am,

Yours truly,
(Signed) C. S. MELLEN,
President.

PRESIDENT'S OFFICE, BOSTON ELEVATED RAILWAY COMPANY,
101 MILK STREET, BOSTON, MASS., July 27, 1910.

DEAR SIR: — General Bancroft, president, desires me to say that he has received and read your letter of July 26, current.

The rule of the company relating to the use of intoxicating liquors

by its car employees is: "The use of intoxicating liquor as a beverage, and the visiting of liquor saloons are forbidden."

Applicants are asked if they have been, or are, users of intoxicants, and are required to make a sworn reply. Habitual users of intoxicants are not hired, and employees who visit a barroom in uniform a second time, or become habitual users of intoxicants, are discharged.

Respectfully,

(Signed) D. F. SMALL.

PRESIDENT'S OFFICE, NEW YORK CENTRAL LINES,
GRAND CENTRAL TERMINAL, NEW YORK, Oct. 19, 1910.

MY DEAR SIR:—Your letter of October 14 has been received. In reply will quote from our rules of the operating department relative to the use of liquors: "The use of intoxicants by employees while on duty is prohibited. Their use, or the frequenting of places where they are sold, is sufficient cause for dismissal."

Very truly yours,

(Signed) W. C. BROWN.

An argument frequently advanced by friends of the liquor interests against any further restriction of the trade is that it is a great public benefactor in that it gives steady employment to thousands of working people. They attempt on all occasions to induce the labor unions to fight for the maintenance of the saloon on the plea that its abolition will mean the loss of employment to all these wage earners. Let us see if this form of occupation is such a boon to the working-class as these persons claim. Thomas Oliver in his authoritative work, "Dangerous Trades," has this to say of barbers and dealers in alcoholic drinks:—

Publicans and licensed victuallers are notoriously a short-lived class. The modern tendency of brewers to buy out the smaller publicans and to form "tied" houses is causing the older type of landlords to disappear, and is replacing them by men often drawn from an inferior rank of life. In large industrial centers the men who are placed in charge of bars or who take over public houses for themselves have frequently been previously engaged in the ordinary trades of the district. As subsequent events too often show, the life adopted, however gilded it may appear, is attended with considerable danger. The occupation of the publican is sedentary. Without any exercise in the open air, his long day is too often spent in an atmosphere reeking with the odor of spirits, tobacco smoke and emanations from the men and women

who lounge at the bar; and this, coupled with the numerous temptations to drink, and his irregular meals, sooner or later induces structural alterations in the liver, lungs, and heart, that bring life to a premature close. According to Ogle, innkeepers and publicans have a comparative mortality figure of 1,521 as against 1,000 of the general population, an unenviable position, which is corroborated by the statistics of the Scottish Amicable Insurance Society, which show that dealers in intoxicating drinks have a mortality of 68 per cent. in excess of the actuaries or healthy male tables, and 49 per cent. in excess of the English life tables. The mortality is 51 per cent., roughly speaking, above that for all males. In no other class of men, as might be expected from the opportunities offered, is the mortality from *alcoholism* so high as in innkeepers and publicans. It is from five to seven times higher than the average. The only occupation that approximates to it from a mortality point of view is that of cabmen.

Working brewers are also unhealthy. They have, according to Ogle, a mortality figure of 1,361 as against 1,521 for publicans, but while they present a lower mortality figure and greater freedom from alcoholism, they have a higher mortality from heart and lung diseases, especially consumption, a circumstance which is attributed to their greater exposure to varying temperatures and to wet, their figures from phthisis (consumption) being 334 as against 295 for publicans. Brewers and their assistants are more liable to accidents, these, like all alcoholic subjects, they bear badly. . . . Taking 100 as representing the mean mortality among all occupied males for each of the subjoined causes of death, the comparative mortality figures for publicans, innkeepers and their servants are 723 from alcoholism, 600 from gout, 271 from diabetes, 644 from diseases of the liver, 210 from urinary diseases and 207 from suicide.¹

The variety of occupations provided by the liquor traffic should, then, be classed among the dangerous trades, and the wage earners would be much better off in some other form of employment.

The laboring classes have been very slow to realize that alcohol is one of their greatest enemies. Among no other class in the community are its ravages so widespread. The time is not far off, I think, when we shall see in this country a change in their attitude towards drink. A beginning in this direction has been made abroad, according to Mr. Robert A. Woods, who said recently: —

¹ Oliver: "Dangerous Trades," 1902, pp. 800-802.

The Socialists of Germany at their last annual meeting passed a resolution against the use of brandy, and since that resolution there has been a considerable drop in the sale of brandy in Germany. Some ten or a dozen years ago Mr. John A. Hobson, one of the ablest, most intelligent and sympathetic students of the labor question in England, after a long review of the labor situation said there is no hope of getting much ahead with the problem which labor organization has before it as long as so great a mass of English workingmen are drugged with alcohol. Since that time there has been a strong temperance movement, so that the majority of the trades union leaders there now are strong temperance men, and nearly if not quite all the labor representatives in Parliament are total abstainers.¹

Much of the poverty, immorality and crime of any community is inextricably associated with the use of alcohol. In 1894-95 the Massachusetts Bureau of Statistics of Labor undertook a very extensive investigation of the relation of the liquor traffic to crime, pauperism and insanity within the Commonwealth. Among other things the Bureau was directed to ascertain "the number of paupers whose present condition can be traced to the use or abuse of intoxicating liquors by themselves or by their parents, guardians or others." As a result it was found that 39.44 per cent. attributed their pauperism to their own intemperance and another (approximately) 5 per cent. to that of their parents, one or both. Figures, no matter how accurately obtained, will vary considerably with various investigators and in various localities, but it is safe to say that drink is responsible for from 35 to 50 per cent. of the poverty existing to-day in this country.

With regard to sexual immorality it is extremely difficult to obtain accurate figures. Physicians are in the best position to judge of this. It is just at the time when judgment and self-restraint are weakened by a few drinks that the average man or woman is led astray. From my own experience, which is in accord with that of other physicians with whom I have talked on this subject, I think it is safe to say that a large proportion of cases of venereal disease are acquired when the patient is under the influence of intoxicating liquors.

Many alcoholics are also syphilitic.

¹ Mr. Robert A. Woods: Speech before the Massachusetts Committee on the Liquor Laws opposing the repeal of the Bar and Bottle Law.

In such persons it very frequently happens that the manifestations of syphilis are erroneously attributed to the action of alcohol alone, whereas the alcohol serves merely to aggravate the disease and render it much less amenable to treatment.

Dr. Mary Scharlieb¹ has this to say of the relation of alcohol to prostitution and disease in women. She is speaking of conditions in England, but her words are significant when considering conditions in America:—

There is no doubt that most of the women who compose that sad army of the fallen have reached this state either because they were intemperate or have become intemperate from the exigencies of their miserable life. Many girls owe their first fall from virtue to the casual glass of fiery, unsound wine or spirit given to them as a treat on some bank holiday or other convivial occasion. . . . Such employment as that of a barmaid (or waitress in a restaurant) leads naturally either from intemperance to immorality, or the girl is first seduced and subsequently becomes a drunkard. The same thing happens in all ranks of life, although of course not so frequently in those positions and employments which are less beset by temptation. It is well known to doctors and to philanthropists that this combination of evil is particularly deplorable, that the woman's health is sure to suffer, and that it too often leads to a miserable and early death. The diseases from which those unhappy girls suffer may be the direct outcome of their sin, and even of those who do not die many are incapacitated for the duties of a wife and mother, even should restored virtue make them otherwise eligible.

The Committee of Fifty for the investigation of the liquor problem made a very careful investigation of the relation of alcohol to crime. The inquiry covered 13,402 convicts in 17 prisons and reformatories in 12 States. Intemperance was found² as one of the causes of crime in about 50 per cent. of the cases, and was a first cause in 31 per cent. These figures agree closely with the results obtained from the investigation conducted by the Massachusetts Bureau of Labor Statistics to which I have already referred. The statistics showed that in 50.88 per cent. of convictions in Massachusetts for crimes other than drunkenness "the intemperate habits of the criminal led

¹ Scharlieb: "The Drink Problem," Kelynack, editor, pp. 186, 187.

² Koren: "Economic Aspects of the Liquor Problem," published by the Committee of Fifty, 1892, p. 158.

to a condition which induced the crime."¹ Of course other causes were acting in conjunction with intemperance in the Massachusetts cases, but the investigation presents no classification into percentages of convictions in which alcohol was a first cause and in which it was a contributing cause. It is safe to say, however, that the intemperate use of alcohol plays a certain part in about half the crimes committed, and is the chief cause of about one-third.

Even from the most conservative estimates we see that the indictment against alcohol is a grave one. The cold figures show that it is largely responsible for one-fifth of the insanity among men; that it is the chief cause of one-third of all crimes; that it induces or greatly aggravates nearly one-half of the poverty existing to-day.

7. SOME COMMON MISCONCEPTIONS WITH REGARD TO ALCOHOL.

Much confusion as to the true nature and action of alcohol has arisen from the fact that it is popularly known as a "stimulant." As we have seen in the preceding pages it has no more right to be called a stimulant than has ether or chloroform. Its action is that of a narcotic from the very first. One of its characteristics is that small doses remove the finer shades of self-restraint and deceive the taker into thinking that he is being stimulated. The sensation of warmth, the ease of speech and freedom from care all contribute to this deception, whereas really they are evidences of the depression of the higher functions of the brain. Careful experiments upon human beings and animals have shown that after being absorbed alcohol has no stimulating action upon the heart or circulation, but that in excessive doses it seriously interferes with the heart's action.

The belief is widespread that alcohol is a sure cure for snake-bite and for the sting of the scorpion or tarantula. For this reason large quantities of raw whiskey, brandy or rum have frequently been given to persons unfortunate enough to have been bitten by rattlesnakes or moccasins. The persons administering these strong liquors rarely stop to consider the age of the sufferer or whether he has been accustomed to the use of alcohol.

¹ Twenty-sixth Annual Report of Massachusetts Bureau of Labor Statistics, p. 137.

The consequence is that many persons have died, not from the snake-bite, but from the overdose of alcohol received. There are instances on record where children have been forced to swallow as much as a pint of whiskey with fatal result. As a matter of fact, alcohol has no beneficial effect whatever in such cases other than to quiet the fears of the patient.¹ The proper thing to do in such an emergency is to tie something around the wounded arm or leg above the point of injury so tightly as to completely shut off the circulation, and then with a sharp, clean knife cut out a small portion of the skin where the fangs entered and suck out the poison. If done immediately this will prove a life-saving measure, whereas dosing with alcohol is useless and may add to the harm already suffered.

In the face of exposure to severe cold many persons feel that they owe it to themselves to take repeated drinks of alcoholic beverages in order to keep warm and prevent taking cold. The result is exactly the opposite from what they desire. They indeed *feel* warmer because of the increased surface circulation induced by the alcohol, but they lose heat much more rapidly than in their normal condition and thereby render themselves more liable to take cold. In extremely cold weather, if the wearing of extra clothing does not suffice to keep one warm, hot tea or coffee may be used, as they really stimulate the heart and circulation.

It is commonly believed that the best method of reviving a fainting person is to give him whiskey or brandy in water. Apart from the burning sensation produced in the mouth and stomach by the alcohol these liquors have no action that would particularly benefit a person in this condition. It is best to place him flat on his back, without any pillow under the head, loosen the collar and let him have a whiff of smelling salts or aromatic spirits of ammonia. If it is an ordinary faint the color will return to his face at once, and he will recover consciousness almost immediately without any alcohol or dashing of cold water over his face. As soon as the general public comes to realize that there are other things which work better than alcohol in such cases, then, and not until then, will the faulty idea that alcohol is a stimulant die out.

¹ Journal of Amer. Med. Ass'n, 1908, Vol. 51, p. 132. Also Archives of Internal Medicine, June, 1908, p. 516.

We have seen that alcohol is an enemy to efficiency in all kinds of activity requiring mental work; that it acts as a depressor of the brain and spinal cord; and that, in moderate amounts, it has little effect upon digestion. For these reasons alcohol is not a good tonic and should not be taken as an aid to digestion. It is a very common experience to find people taking sherry or claret because they feel somewhat "run down" and want a tonic. According to Chittenden and Roberts these wines simply add an extra load to digestion because of substances other than alcohol which they contain. The alcohol, again, is simply serving to make the run-down person feel better temporarily and, in addition, is aggravating the exhaustion of the nervous system. It is true that in very severe illness, where little or no nourishment is taken, alcohol is of distinct value as an emergency food requiring no digestion. Here its narcotic effect may be of benefit also in quieting the fears of the patient, but in any case it should be used only under the careful direction of a physician. The medicinal use of alcoholic liquors in the large hospitals of England and America¹ has diminished greatly in the last few years. Whereas formerly they were given almost universally in such diseases as tuberculosis, typhoid fever and pneumonia, to-day many physicians consider that alcohol is contraindicated in these cases.

The brewers have done all in their power to keep alive the belief that beer, ale, stout and porter are excellent forms of nourishment. They keep repeating the myth that "beer is liquid bread," thereby trying to create the impression that there is as much real food in a bottle of beer as in a loaf of bread. The analyses of beer and bread here given show how far from the truth such an impression is. Harrington² says:—

The most important constituents of beer are the extract and alcohol. The extract includes all of the nonvolatile matters in solution, and consists of proteid matters, dextrin, sugar, hop resin, and other substances left as a residue on complete evaporation. The amount is variable; it is highest in porter, stout and bock beer, and lowest in the light-colored lager beer. In the former it averages about 7.50 per cent. and in the latter, about 5.50 per cent. Twenty-eight specimens of American beers,

¹ Cabot: Boston Med. and Surg. Journal, 1909, Vol. 160, p. 480.

² Harrington: "Practical Hygiene," 3d edition, 1905, p. 180.

ales and porter collected in Washington, and analyzed by Mr. G. A. Crampton, averaged 5.53 per cent. . . .

The amount of alcohol is also variable. The specimens examined by Crampton averaged 4.63 per cent. by weight.

The same authority says,¹ with regard to the composition of wheat bread, "Wiley gives the following as the approximate composition of a 'typical American high-grade yeast bread made with best flour and in the most approved manner:'" —

	Per Cent.
Moisture,	35.00
Proteids (albuminous substances),	8.00
Ether extract,75
Ash,	1.50
Fiber,30
Carbohydrates (starches and sugars),	54.45
	<hr/>
	100.00

In other words, if we regard all the extractives of malt liquors as well as the alcohol constituting available food matter — which is probably not the case — in a bottle of beer there is —

	Per Cent.
Available food matter (extractives and alcohol),	10.50
Water and volatile substances,	89.50

whereas in a loaf of good wheat bread there is —

	Per Cent.
Available food matter (sugars, starches and proteids),	62.50
Water, ash, etc.,	37.50

Thus we see that in a given amount of bread by weight there is six times as much food matter as in a given amount of beer, but even this comparison does not show the true superiority of bread over beer. The nutritive material in bread does no harm to the body, but the alcohol of beer if taken in large amounts is capable of doing much harm and may lead to the taking of stronger liquors. I have under my care at the present moment a woman who was instructed by a friend to take porter regularly so as to have plenty of milk to nurse her baby. She became so fond of the porter that she continued to use it after the

¹ Harrington: *Loc. cit.*, p. 141.

child was weaned. Then she began to crave stronger alcoholic beverages and gradually formed the habit of taking whiskey and brandy. Her child is now five years old, but she has just come to the realization that she is a chronic drinker. A woman of great self-respect and of good family, she came to me in deep distress of mind because she has found that she cannot resist the temptation to drink when the craving comes on. Even were alcohol devoid of such harmful effects the greater expense of malt liquors would exclude them from use as food by the average individual. Many times the price of a loaf of bread would have to be spent before its equivalent in nourishment could be obtained from beer or ale.

It is a common experience to hear people say that "good brandy or whiskey never hurt anybody;" that all the harm in drinking comes from the fusel oil and other poisons in cheap liquors. Cushny¹ states that there is no satisfactory evidence that fusel oil, furfural or other substances sometimes found in distilled spirits are responsible for the symptoms of chronic alcoholism, but that the alcohol alone is responsible for the harm done. Investigations² carried on in Europe and America have shown that fusel oil occurs in liquors in such minute quantities as probably to warrant us in disregarding it as a source of harm to health. As a matter of fact the cheaper grades of whiskey contain less fusel oil than the more expensive brands.³ In all liquors in common use in America whether fermented or distilled it is the alcohol which does the principal harm, and the damage done is in direct proportion to the alcoholic content. Whiskey, brandy and rum are the most harmful because they contain alcohol in concentrated solution,—about 50 per cent. If these are taken straight, that is, without diluting them with water, they produce considerable local irritation in the mouth, throat and stomach, and the drinker receives large doses of alcohol in a small amount of the liquor taken. Naturally, when used in moderation, the malt liquors are the least harmful because they contain little alcohol,—on the average about 5 per cent. This is so greatly diluted by the large volume of water present that it has no local irritating effect upon the

¹ Cushny: "Textbook of Pharmacology and Therapeutics," 1906, p. 145.

² "Physiological Aspects of the Liquor Problem," Vol. 2, pp. 10, 323, 325.

³ *Ibid.*, p. 9.

mucous membrane of the mouth or stomach. If beer and ale are taken habitually in large amounts, however, they injure the body in two ways. Apart from the damage done by the alcohol they contain, they overburden the heart and circulation in the manner already described.

Appended is a table¹ of the percentage of alcohol in the more common intoxicants.

TABLE 1.—*Composition of Malt Liquors.*

(Proportions by Weight.)

BEERS, ALES, ETC.	Alcohol (Aver- age Per Cent.).	BEERS, ALES, ETC.	Alcohol (Aver- age Per Cent.).
<i>European.</i>			
German weiss beer,	2.7	Weiss,	1.7
Pilsen lager beer,	3.3	Lager,	3.8
Vienna lager beer,	4.7	Ale,	4.6
Munich lager beer,	4.8	Porter,	4.5
Bavarian beer,	3.6		
Saxony beer,	2.7		
English ales and porter,	5.0		

TABLE 2.—*Compositions of Wines and Ciders.*

(Proportions by Weight.)

	Alcohol (Aver- age Per Cent.).		Alcohol (Aver- age Per Cent.).
<i>European Wines.</i>			
French, clarets (Konig),	8.0	<i>American Wines.</i>	
French, clarets (English analyses),	10.0	Dry, red,	9.0
French, white (Konig),	10.3	Dry, white,	9.4
French, white (English analyses),	10.3	Sweet:—	
German, Rhine (red),	8.6	Port,	13.0
Moselle, etc. (white),	8.7	Sherry,	15.5
Sweet wines:		Sweet catawba,	12.0
Tokay,	10.0	Champagne,	8.0
Marsala,	16.0	<i>Ciders.</i>	
Malaga,	12.0	French, fermented,	4.0
Sherry,	17.5	French, sweet,	2.0
Port,	17.0	American, fermented,	5.0
Madeira,	15.4	American, sweet,	1.4
Champagne,	10.0		

¹ "Physiological Aspects of the Liquor Problem," pp. 337, 338, 340.

TABLE 3.—*Composition of Distilled Liquors.*
(Proportions by Weight.)

	Alcohol (Average Per Cent.).		Alcohol (Average Per Cent.).
<i>European.</i>			
Brandy, cognac, genuine, from wine,	47.0	Brandy, from wine,	45.0
Brandy, from spirits,	39.0	Whiskey, genuine,	43.0
Gin,	30.0	Whiskey, inferior grades,	35.0
Rum,	60.0		
Whiskey,	40.0		
Schnapps, German,	38.0		
Liqueurs:—			
Benedictine,	38.0		
Chartreuse,	32.0		
Curacao,	42.0		
Absinthe,	51.0		
Swedish punch,	19.0		

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